STATUS OF THE CLAIMS

Claims 1-5 are pending in the application.

Claims 1-5 were rejected under 35 USC§102(b) as being anticipated by Rabenau '101.

Claims 1-5 were rejected under 35 USC§102(b) as being anticipated by Benz et al. '497.

Claims 1-5 were rejected under 35 USC§102(e) as being anticipated by Reschnar et al. '824.

Claims 1-3 are currently amended by this Amendment.

Claims 1-3 (currently amended), and original Claims 4 and 5 are pending in the application following entry of this Amendment.

REMARKS

SUMMARY OF THE INVENTION

Laminates consisting of a high-damping core material sandwiched between two stiff, weldable skins. The laminates are comprised of 100% metal constituents, and do not rely on epoxy or low-melting point solders. To make the laminate structures, a first alloyable metal is deposited on the surface of a dissimilar metal. The coated surface is then placed in contact with a second alloyable metal and allowed to interdiffuse at elevated temperatures. The metals are chosen such that diffusion creates an alloy with a melting point lower than either of the constituents. The processing temperature is set so that the alloy melts but leaves the base metals in solid form, causing a thin layer of liquid

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to form and wet both sides of the interface. External pressure is applied to the opposing base metals in such a way as to induce flow of the liquid layer and disrupt any oxide layers present on the surface of one or more of the base metals. Continued diffusion elevates the melting temperature of the liquid phase and causes it to solidify isothermally, creating a bond between the base metals. Highly polished surfaces on the base metals comprising the laminate structure are not required because the applied pressure causes the metal (in thin sheet form) to deform and create the intimate metal-metal contact necessary for diffusion. Moreover, the liquid flow helps to fill gaps between the parent materials and further mitigates the need for polished surfaces.

<u>The Rejections Under 35USC§102(b)</u>

Claims 1-5 were rejected under 35USC§102(b) as being anticipated by both Rabenau '101 and Benz et al. '497. The Examiner asserts that Rabenau '101 teaches the present invention as claimed. Applicant respectfully disagrees with the Examiner. Briefly, Rabenau '101 discloses a laminate structure similar to, but different than, the laminate structure of the present invention. The Examiner states that Rabenau '101 teaches that the laminate structure is made by heating the compressed structure [to a phase transition temperature and maintaining the compressed structure at the phase transition temperature] and then cooling (bracketed language is Applicant's).

There are distinct differences between the laminate structure taught by Rabenau '101 and the laminate structure of the present invention. First, Rabenau '101 teaches bonding of a heterogenous bearing alloy to steel by introducing a layer of homogenous

light metal to the surface of the bearing alloy. This process encapsulates the bearing alloy, effectively sequestering the lead portion (or phase) of the bearing alloy. This, in turn, allows the encapsulated bearing alloy to be roll bonded to steel, thereby joining the steel and homogenous encapsulant material, without releasing or pushing out a phase of the bearing alloy. As set forth in Rebenau, "bonding can be carried out by the known roll-bonding procedure." (col 1-line 63) Bonding in this case is due to the heat and strain caused in the roll-bonding process, and is a well understood process wherein the metallic bonds are formed in a short time-frame (milliseconds to seconds) directly under the bonding rolls.

In contrast, the present invention discloses and claims a laminate structure the present invention wherein the bonding mechanism arises from interdiffusion of the metal coating with a base metal. In contrast to roll bonding, this process is time dependant and is a form of transient liquid phase bonding. <u>In the method of the present invention, the metals must be held in intimate contact for a sufficient time to allow diffusion of these materials. The diffusion of the metals creates an intermediate alloy that has a lower solidus temperature, thus forming a liquid phase.</u> The temperature at which this process happens is known as a phase transition temperature, as defined in the specification. The phase transition temperature is defined as being lower than the melting point of either the base betal or the alloyable metal. The liquid phase will intimately wet both base metals. Further diffusion results in isothermal solidification, creating the metallic bond. This process requires several minutes to achieve, since it is a diffusion limited bonding mechanism.

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In order for a patent to qualify as a reference supporting a §102 (b) rejection, it must disclose each and every limitation of the rejected claim. It is settled that even only slight differences between the compared inventions prevent a rejection based on lack of novelty under §102. Anticipation under 35 USC§102 requires that the cited references demonstrate each and every element of the claimed invention. In the present invention, the laminate structure includes an interface between the base metals that includes first and second alloyable metals and an alloy formed therefrom at a transition temperature that is below the melting point of either of the alloyable metals. Benz et al. '497 teaches the creation of microstructured plate assemblies, using solder foils or powders that are below 25 microns in thickness. This strategy allows soldering of the plates in such a way that the microchannels of the assembly are not blocked. The interface composition is lacking in both the Rabenau '101 and the Benz et al. '497 references. In view of the differences between the elements of the present invention and those of the prior art presented herein, it is requested that this rejection be withdrawn.

The Rejection Under 35USC§102(e)

Claims 1-5 were rejected under 35USC§102(e) as being Reschnar et al. '824. The Examiner argues that Reschnar et al. teach the method of the present invention. Again, Applicant respectfully disagrees. Reschnar et al '824 teaches a very similar method of bonding staked plates, and shows that compressing the assembly in a cold state deforms the solder foils or coatings to create more intimate contact. In this way, the compression force required at the soldering temperature is lessened. It is important to note than when Reshnar

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refers to "solder diffusion process" that he referring to the well known "solder process". The word diffusion in this context refers to the migration of solder along an interface, and differs fundamentally from atomic diffusion.

Solders and the use of solders to bond structures differ substantially from the present invention. Solders utilize low-melting temperature eutectic alloy compositions, such as can be found in the lead-tin system. In the case of a solder foil used to bond two plates, the stacked assembly is heated above the solidus temperature of the solder, Tm, causing the solder to melt and wet the opposing surfaces of the plates to be bonded. A solder bond is formed when the structure is cooled. Upon reheating of the assembly to the original processing temperature Tm, the solder will once again melt and the assembly can be removed. In addition, the melting of the solder is due only to temperature, and does not rely on compositional changes, so the process can be done in seconds and is limited only by engineering practicalities.

The present invention does not use solder. Instead, the process involves interdiffusion of metals that are not eutectic alloys to create a liquid phase. This occurs because of compositional changes at the bonding interface due to migration of atoms across the interface, resulting in a lower solidus temperature. This is known as the phase transition temperature. The liquid phase will intimately wet both base metals. Further diffusion results in isothermal solidification, creating the metallic bond. This process requires several minutes to achieve, since it is a diffusion limited bonding mechanism. In addition, unlike solders, when heated to the initial processing temperature, the bond will not melt as it has changed composition. The present invention, therefore, results in a more thermally stable bond. In view of these clarifications regarding the difference between the

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elements of the present invention and the prior art it is requested that this rejection be withdrawn.

Entry of this amendment, reconsideration, favorable action and early allowance and publication of this application are respectfully requested. If there are any minor matters remaining, it is respectfully requested that the examiner contact the undersigned by phone so that possible minor changes may be discussed in order to expedite the prosecution of this case.

Respectfully,

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CERTIFICATE OF FACSIMILE TRANSMISSION

I hereby certify that the following papers are being facsimile transmitted to the Patent and Trademark office on the date shown below.

1. Urgent and Time Sensitive Communication to the Examiner
2. Amendment A responsive to the Office Action dated 8/5/05.

Michael G. Petit

Date: November 7, 2005

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